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Delegation and coordination with multiple threshold public goods: experimental evidence

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Abstract

When multiple charities, social programs and community projects simultaneously vie for funding, donors risk mis-coordinating their contributions leading to an inefficient distribution of funding across projects. Community chests and other intermediary organizations facilitate coordination among donors and reduce such risks. To study this, we extend a threshold public goods framework to allow donors to contribute through an intermediary rather than directly to the public goods. Through a series of experiments, we show that the presence of an intermediary increases public good success and subjects' earnings only when the intermediary is formally committed to direct donations to socially beneficial goods. Without such a restriction, the presence of an intermediary has a negative impact, complicating the donation environment, decreasing contributions and public good success.

Keywords Delegation · Threshold public goods · Laboratory experiment · Fundraising

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1 Introduction

In threshold public good games, players choose how much (money, time or effort) to contribute towards a public good that will provide benefits only if total contributions exceed a minimum level. Such games can be used to model strategic contribution decisions involving crowdfunding projects, social movements, and charitable giving. In the games, individuals choose how much to contribute to a common cause, while recognizing that their contribution may have a meaningful impact only if the cause also receives enough support from others to be viable. For example, philanthropists who wish to support the construction of a new community arts center recognize that their contribution will only have its intended effect if total contributions from all donors are high enough for the project to move forward. Except in the case of very large donors who can unilaterally ensure the success of a project, donors prefer to contribute to projects that receive enough funding from others to be viable, but not so much funding from others that the marginal impact of their own contribution is low.

Further complicating the donor decision is the fact that, in many settings, multiple projects or opportunities simultaneously vie for donor funding. Donors must choose not only how much to contribute, but also to which projects or charities to contribute. In these settings, donors are exposed to the additional risk that they inefficiently spread contributions too thinly across projects. Corazzini et al. (2015) (henceforth CCV) extend the threshold public good environment to allow for multiple public goods simultaneously vying for funding, and show how increasing the number of public goods can discourage giving, decrease total contributions and increase the probability that all public goods fail.

The present paper extends the multiple threshold public good environment from CCV to allow for strategic delegation.[1] Here, donors may provide their contributions to an intermediary, which then chooses how to allocate total contributions across potential uses. The presence of an intermediary has the potential to simplify donor strategies and reduce coordination problems. No longer must one choose how to allocate contributions across alternative projects. One must simply choose *how much* to contribute, leaving the decision about *where* to contribute in the hands of the intermediary. The use of delegation strategies may avoid situations where contributions are spread inefficiently across projects. The presence of an intermediary could therefore encourage contributions and increase the probability that public goods successfully reach their funding thresholds.

Intermediaries are common in real world philanthropic environments (Chlass et al. 2015; Coffman 2017; Giving.USA.Foundation 2018). Americans gave more than 410 billion to charity in 2017 (2.1% of the GDP). Voluntary contributions represented 70% of total giving of which only 2% did not flow through

[1] The literature review discusses several recent papers that extend CCV in other directions.

organizations and intermediaries (Giving.USA.Foundation 2018). Many large non-profits are involved with a variety of projects and choose how to allocate contributions they receive across alternative uses. Furthermore, some prominent organizations exist with the specific mission of encouraging and coordinating philanthropic efforts for their causes or within their communities.

At the cause level, for example, the Susan G. Komen Foundation raised approximately $400 million to reduce cancer deaths during the 2009–2010 fiscal year. The organization then choose how to allocate its funds across related activities such as funding various research projects (21%), education campaigns (39%), providing cancer screening and treatment (19%), and fundraising and administration (21%) (Susan G. Komen Foundation 2010). At the community level, community chest organizations such as the United Way operate in many locations to encourage and coordinate local donor efforts. In 2016, United Way pooled funds from more than 9 million individual donors and 60, 000 corporate partners for a total of $4.7 billion raised. It also managed a network of 1, 200 local offices in 40 different countries and coordinated the volunteer efforts of 2.9 million individuals. The funding activities and the volunteer efforts supported projects in 1800*communities*, serving more than 60 million people (UnitedWay 2016; Economist 2017).

Typically, individuals choose how much to contribute to their preferred cause's foundation or a local United Way. Then the organization decides how to allocate the sum of its contributions across many viable projects and organizations in order to maximize the social impact of the donations. By contributing through the United Way or related organizations, individuals do not need to strategize about whether their own donations are optimal given the allocation decisions of others. They simply choose how much to give and defer to the intermediary organization to allocate their contributions across projects in the optimal way.

After incorporating an intermediary organization into a repeated multiple threshold public good game, we show experimentally that the effectiveness of such organizations depends heavily on the formal restrictions placed on its use of donor funds.

First, we consider an environment in which the intermediary is under no obligation to allocate donor funds to a use that is valued by the donors. This need not be interpreted as illegal theft or embezzlement of funds, but, rather, it captures the possibility that an organization may be able to direct contributions towards increasing its staff size or salaries, or towards projects that are unrelated to the projects donors hoped to fund. However, just because an intermediary can expropriate funding doesn't mean that it will do so. Intermediaries may feel obligated to use funding in accordance with donor expectations, especially in dynamic environments where fund use today may affect future donations.

Second, we consider an alternative version of the environment in which a "destination rule" formally requires that the intermediary pass along the entire value of the donors' delegated contributions to public goods. Redirecting all or part of the delegated contributions for private benefit is no longer possible. Such a destination rule is consistent with non-profit sector regulations or public commitments made by

NGOs that generally improve transparency regarding the use of funds and limit the share of contributions that can be directed to overhead or administrative costs.[2]

In both environments, the presence of an intermediary may reduce the risk of donors contributing to projects that do not receive enough support from others to be viable. In doing so, the presence of an intermediary may potentially encourage contributions and increase public good success and payoffs. In the unrestricted delegation environment, however, donors face a dimension of risk that is not present with a destination rule: they face uncertainty about whether the intermediary will work in the public interest, and risk that their contributions will not be passed along to a public good. Regardless of whether the intermediary intends to behave outside of the public interest, donors face the possibility that it might.

The relative risk associated with contributing is lower in the delegation game with a destination rule than it is in either the game without delegation or the game with unrestricted delegation. We therefore expect delegation to increase contributions and public good success when intermediaries face restrictions on their use of funds. It is less clear, however, whether the presence of an intermediary will increase contributions and public good success when there is no destination rule. Unrestricted delegation reduces the risk of mis-coordination among donors, while simultaneously introducing the risk of intermediary expropriation. Which dimension of risk is more effective at discouraging contributions is an empirical question, which we consider experimentally.

In the laboratory experiment, we show that the presence of an intermediary increases success of public goods and overall welfare only in the setting with a destination rule. With a destination rule, the ability to delegate donations has a significant positive impact on public good funding, including coordination, success rates and payoffs. When the intermediary does not face formal restrictions on the use of funds, however, donors contribute even less than in the case without an intermediary. Without a destination rule, the presence of an intermediary does not help increase contributions or improve public good success, leading to worse outcomes for groups and less success for the public goods they are trying to support.

Together, these results suggest that an intermediary organization can help facilitate coordination among donors and successful funding of public goods. For this to be the case, however, donors must have reason to believe that the intermediary will use their donations effectively. Without this confidence, the presence of an intermediary can decrease contributions and public good success.

Our findings highlight the potential for community chest organizations and other intermediaries, and the benefits from such organizations restricting how they are able to use donations ahead of any funding drive. They also illustrate a channel through which regulations and oversight of charitable organizations, such as rules

[2] It is also related to donors adding conditions to their contributions that require funding to be spent in certain ways. Large donors often add restrictions to an organization's use of their funds. There is not only a moral obligation for non-profits to honor donor's wishes, but they are also required by law to do so (Brody 1998; Bac 2002; Goodwin 2005; Atkinson 2008). Under destination rules, NGOs must be careful in choosing how to use donations as, in case they do not comply with the initial intent, donors can take legal action, resulting in substantial monetary and reputation costs for the intermediary.

governing the portion of donations that may be directed to administration, may facilitate donations and lead to more successful charitable giving.

2 Literature review

There is a substantial and growing literature using laboratory experiments to consider the decisions of individuals to contribute to public goods. Within this literature, our analysis is most related to the papers that consider the allocation of contributions across multiple goods (e.g. Blackwell and McKee 2003; Moir 2006; Bernasconi et al. 2009) and the papers which focus on threshold public goods (Bagnoli and Lipman 1989; Andreoni and Gee 2015), which is sometimes used to model donor contributions to charitable organizations and fundraising projects (Andreoni 1989, 1998).

Several recent papers, beginning with CCV (first discussed in the introduction), consider environments in which donors allocate contributions across several different threshold public goods. Such a framework is a stylized representation of an environment in which multiple charities or fundraising projects simultaneously vie for donations. CCV show how increasing the number of public goods in such an environment can make coordination among donors more difficult to achieve, which discourages donations and makes it less likely that any public good succeeds. Several recent papers consider related extensions of this framework. Ansink et al. (2017) considers the impact of seed money on contributions and extends the framework to allow for giving in continuous time. Cason and Zubrickas (2018) and Liu et al. (2016) considers the impact of rebates when a public good fails to achieve its threshold on contributions in a multiple good setting.[3] These papers consider various aspects of how inefficiencies arise as multiple projects vie for funding. Our paper contributes to this literature by exploring the role of donation intermediaries.

The idea that delegation can improve coordination has been well studied in a variety of other strategic environments. Theoretical analysis of the topic focuses mainly on principle-agent settings (e.g. Aghion and Tirole 1997; van den Steen 2006; Hammon et al. 2010) and the theory of firm (e.g. Vickers 1985). Empirical research on delegation has devoted attention to contexts such as corporate governance (e.g. Alfoldi et al. 2012), management (e.g Sengul et al. 2012) and labour relations (e.g. Charness and Sutter 2012). Our focus on delegation in charitable giving represents a novel focus of research. Furthermore, our evidence shows how delegation can decrease outcome efficiency when preferences donor and intermediary preferences are not fully aligned. This is related to the work on trust-related concerns between principals and the delegated entities. Opportunistic behavior, essentially related to free-riding (e.g. Gur and Bjørnskov 2017; Herz et al. 2016; Löschel and Rübbelke 2014; Brown et al. 2012) leads to delegation failures and sub-optimal outcomes. Hidden costs of the intermediation such as inefficient administration and embezzlement (e.g. Chlass et al. 2015; Di Falco et al. 2016), as well as explicit prices like

[3] See also Bouma et al. (2018).

overhead fees (e.g. Gneezy et al. 2014; Butera and Houser 2018) represent further aspects that negatively affect intermediation, especially in charitable giving contexts. In our experiments, we compare outcomes in a setting in which a delegate is unable to act outside of the interests of the others players and a setting in which delegate behavior is unrestricted (and trust-related concerns are relevant). This allows us to identify the degree to which such concerns affect donor behavior and outcomes in our environment.

Related to our paper, a recent strand of experimental research has confirmed the positive effects generated by delegation-based mechanisms in voluntary contribution settings. In this literature, the discretionary power on financing a public good is given to intermediaries, either endogenously elected by the group members (e.g. Hamman et al. 2011; Bernard et al. 2013; Kocher et al. 2018) or exogenously appointed (e.g. Oxoby 2013; Makowsky et al. 2014; Hauge and Rogeberg 2015). Bolle and Vogel (2011) examine the effect of using either an endogenous or an exogenous procedure to appoint the intermediary, finding that both delegation schemes stimulate the provision of public goods in the short run. Taking another approach, Kocher et al. (2018) study the effect of delegation when a global public good benefits multiple groups of agents and investigate whether welfare increases when groups delegate the contribution decision to a single (delegated) player. Results show that electoral delegation substantially increases inter-group cooperation, and that re-election incentives prevent representatives from excessive exploitation of their constituents. Bernard et al. (2013), Stoddard et al. (2014), and Stoddard et al. (2019) consider a similar problem devising a tragedy-of-the-commons game in which players choose how much to extract from a common pool of resources. They provide further supporting evidence on the general conclusion that delegation can lead to higher payoffs, in this case reducing the severity of tragedy of the commons. None of these papers focus on delegation in a multiple public good or threshold public good environment.

A connected stream of literature looks at the role of leadership on voluntary provision of public goods. Leaders are defined as the first movers in choosing contributions to a public good. A leader's contribution is observed by other group members before they choose their own individual contributions. It is found that leaders, by setting a virtuous example, can positively influence followers' contributions both in public good (Levati et al. 2007; Rivas and Sutter 2011; Jack and Recalde 2015; Drouvelis et al. 2017) and common pool settings (Buchholz and Sandler 2017). Delegation, as we consider in our experiment, represents an alternative means of improving contributions.

3 Experimental design

Our experimental design extends the multiple threshold public good setting of CCV to include treatments in which subjects can delegate their contributions to one group member (the "intermediary") who then decides how to allocate the delegated contributions across different public goods.

We present results from three distinct treatments with multiple public goods, using a between-subject design:

- *No delegation* (*NoDel*)—Benchmark treatment with multiple public goods and no delegation based on the setting in CCV.
- *Delegation without restriction* (*Del*)—Treatment with multiple public goods and the option to delegate contribution to an intermediary but with no destination rule.
- *Delegation with destination rule* (*DelRule*)—Treatment with multiple public goods, the option to delegate contributions to an intermediary and a destination rule restricting her behavior.

In the last part of the data analysis, we also report results from three additional and analogous treatments in which there is only one available public good, *NoDel*[1], *Del*[1], *DelRule*[1], that are intended to disentangle the role played by multiplicity of public goods in mediating the effects of delegation.

72 subjects participated in each treatment, for a total of 432 participants in the experiment. In each of the treatments, 18 groups of four participants were formed. These groups were kept constant throughout the experiment. Each group participated in a repeated threshold public good contribution game with 12 rounds of repetition. Subjects received feedback about the results at the end of each round. We describe the treatments in detail below.

3.1 No delegation treatments

In every period of *NoDel*, each participant is endowed with 55 tokens. Participants independently and simultaneously choose how to divide their endowment between a "private account" and twelve "collective accounts", indexed by n. For each token put into his own private account, a subject receives a return of two points. Each token put into a collective account n returns a benefit of B_n to all players. The benefit associated with a collective account depends on total contributions to that account from all players, denoted C_n, with

$$B_n(C_n) = \begin{cases} 0 & \text{when } C_n < 132 \\ C_n + b_n & \text{when } C_n \geq 132, \end{cases} \tag{1}$$

where $b_n \in \{20, 30\}$ denotes the bonus associated with that good. When total contributions to n do not achieve the threshold of 132 tokens, the contributions to that good are forfeited. When they reach or exceed the threshold, all players benefit equally. The threshold is set at 60% of the total endowment, assuring that at most one public good can be effectively funded.[4] Four of the collective accounts offer bonuses $b_n = 30$ and eight offer $b_n = 20$. Otherwise, the goods are identical.

[4] The marginal per capita return to the collective account equals 0.5 meaning that the marginal return to a subject from successfully contributing to a collective account (namely, once the threshold is reached) is half the return from the private account.

In the single public good environment with no delegation, *NoDel*[1], the collective account has a threshold of 132 and offers a bonus of 30 in case of successful contribution.

3.2 Delegation treatments

We extend the multiple threshold public good environment to allow for delegation in two ways. Treatments *Del* and *DelRule* add an initial stage to the *NoDel* treatment in which group members can make transfers to an intermediary player. There are still four group members, each endowed with 55 tokens, and three of the group members can transfer any number of tokens between 0 and 55 to the fourth group member. In the second stage, players contribute to public goods in the same way that they did under *NoDel* except that their updated endowments reflect the first stage transfers. The only difference between *Del* and *DelRule* concerns restrictions placed on the intermediary's use of the transferred funds in the second stage. In *Del*, there are no restrictions in how the intermediary may allocate the transfers received between public goods and her private account. In *DelRule*, the intermediary cannot direct transfers received from other players to her own private account; she must direct transfers to a public good.

In the two treatments with a single collective account, *Del*[1] and *DelRule*[1], delegation is based on the same experimental features used in *Del* and *DelRule*.

3.3 Procedures

Upon their arrival to the lab, subjects were randomly assigned to a computer terminal. At the beginning of the experiment, instructions were distributed and read aloud (see the online Supplementary Material for the instructions used in *DelRule*). Before the first period started, subjects were asked to answer control questions at their terminal to ascertain their understanding of the procedure and instructions. Subjects' questions about procedures and instructions were answered privately.

In each period of *Del* and *DelRule* (and later *Del*[1] and *DelRule*[1]), subjects participated in two consecutive phases: a delegation phase and a contribution phase. At the beginning of the delegation phase, the computer randomly chose one of the group members to serve as an intermediary, and subjects were privately informed about their role.[5] Non-intermediary group members simultaneously chose how much of the initial endowment to transfer to the intermediary. The intermediary did not make any choice in the delegation phase. At the end of the delegation phase, subjects received feedback on the overall amount transferred to the intermediary, and their own updated endowment that they would have access to in the contribution

[5] More precisely, in every period, the probability of a group member to be assigned to the role of delegate was kept equal to 25% and independent across repetitions.

phase. For the non-intermediaries, this equaled 55 minus any transfer they made in the first stage. For the intermediary, this equaled 55 plus the sum of transfers from others.

At the beginning of the contribution phase, each subject was presented with a number of bins (on the terminal screen) equal to the total number of private and collective accounts (thirteen in *NoDel*, *Del*, and *DelRule*; two in *NoDel*[1], *Del*[1], and *DelRule*[1]).[6] Each of the twelve boxes of the collective accounts showed the threshold and the size of the corresponding bonus.

The twelve collective accounts were divided into two groups. Four were efficient, assigning a bonus of 30 points in case the group contributed more than the threshold, and eight were inefficient, with a respective bonus of 20 points. The four efficient public goods were randomly selected in periods 1, 5, and 9, and were kept unchanged for four consecutive periods. The random reshuffle of the efficient public goods every four periods was motivated by two important considerations. First, it allows us to investigate the effects of delegation in settings characterized by mis-coordination, still preserving the possibility that, in subsequent periods, subjects could develop coordination over multiple alternatives even without delegating resources. For instance, subjects could simply use contributions to signal to the other group members the alternative to opt for in the next period.[7] Second, we believe that reshuffling the public goods captures an important feature of the real world. As much as social needs continuously emerge overtime (consider for instance intervening after earthquakes and other natural disasters, supporting schools, communities, sick people), also charitable options are strongly volatile and change overtime. In these situations, donors do not have enough experience and information to successfully coordinate their actions on the same option.[8]

At the end of every period, each subject was informed about the number of tokens allocated by the group to each collective account, whether the corresponding

[6] In order to minimize frame effects associated with letter or number labels, the twelve collective accounts in *NoDel*, *Del*, and *DelRule* were labeled using colors: white, yellow, green, red, light blue, blue, gray, violet, brown, pink, black, and orange. Also, subjects in these treatments were told that the order of (but not the label associated with) the boxes of the collective accounts on their screen was randomly determined by the computer in every period.

[7] At the same time, we did not want to reshuffle every period in order to preserve the possibility that subjects could effectively use past experience (instead of delegation) to guide their contribution decisions after achieving coordination. Our experimental design was chosen to allow for several high-likelihood-of-mis-coordination periods and other more-stable periods in the same setting.

[8] To better analyze the impact of delegation on coordination and contributions in a setting with multiple public goods, the present experimental design departs from the original one introduced by CCV in the number of collective accounts as well as in how heterogeneity is manipulated. First, having 12 (instead of 4 in CCV) collective accounts guarantees that (i) the set containing the efficient alternatives can be entirely changed every four periods and (ii) each alternative is included in the set of efficient accounts for a single 4-period block only. Second, differently from CCV, both the sets of efficient and inefficient collective accounts contain multiple indistinguishable alternatives (more precisely, as mentioned above, 4 efficient and 8 inefficient accounts). Therefore, even under the hypothesis (validated by CCV) that subjects focus their attention on the most efficient collective accounts, they still face the risk of mis-coordinating contributions on different alternatives, as none of the efficient collective accounts in a 4-period block is focal. Therefore, at least in the first of each 4-period block, delegation can help mitigate the coordination problem, still preserving the possibility that groups develop different coordination strategy.

threshold was reached, and any bonus paid. Additionally, following each period, subjects learned the number of points they received from each account and in total.

The experiment took place at the Bocconi Experimental Laboratory for Social Sciences (BELSS) at Bocconi University, Milan, in June 2017. Participants were mainly undergraduate students recruited using the SONA recruitment system.[9] The experiment was computerized using the *z-Tree* software (Fischbacher 2007). At the end of the experiment, points earned by subjects were converted at an exchange rate of 1 euro per 120 points and monetary earnings were paid in cash privately. On average, subjects earned 14.50 euros for sessions lasting 60 min, including the time for instructions and payments. Before leaving the laboratory, subjects completed a short questionnaire containing questions on their socio-demographics and their perception of the experimental task.

4 Delegation and multiplicity: theoretical insights and testable predictions

In this section, we present a game theoretic model of threshold public goods adapted from CCV. We then discuss how this model may be extended to incorporate delegation rules, and the impact of these extensions on the predictions of the model (in the Online Appendix, we provide a formal analysis). This discussion leads to several testable hypotheses, which guide the experimental design and analysis.

4.1 Model of threshold public goods without delegation

There are J players, indexed $j \in \{1, \dots, J\}$. Each player receives an endowment y at the beginning of the game. Players simultaneously decide how much of their private endowment to contribute to each of N public goods. The contribution of player j to good n is denoted by $c_{j,n} \geq 0$. Let $C_n \equiv \sum_j c_{j,n}$ and $c_j = \sum_{n=1}^{N} c_{j,n}$ denote the aggregate contributions to good n and the total contributions made by player j, respectively. A player's total donations cannot exceed his endowment: $c_j \in [0, y]$.

Function $B_n(C_n) = B(C_n)$ determines the benefit each player receives from public good n. The benefit depends on whether total contributions reach some contribution threshold, τ, below which the public good fails to return any benefit. For each good n,

$$B_n(C_n) = \begin{cases} 0 & \text{when } C_n < \tau \\ C_n + b_n & \text{when } C_n \geq \tau. \end{cases} \tag{2}$$

When the threshold is reached, the public good returns a benefit to each player that is increasing in total contributions, plus a bonus of b_n associated with good n. Any unit of endowment not contributed to a public good gets directed to private consumption, where it returns a marginal benefit of two (implying a marginal per capita

[9] http://www.sona-systems.com/default.aspx.

return to the public good is 1 / 2 that from private consumption). Therefore, player j earns total payoff:

$$u_j(c) = 2(y - \sum_{n=1}^{N} c_{j,n}) + \sum_{n=1}^{N} B(C_n) \tag{3}$$

We assume that $J = 4$, $y = 55$, $\tau = 132$ and $b_n \in \{20, 30\}$. These are the parameters incorporated into our experiment. They assure that groups can fund at most one public good at its threshold, that players are unable and unwilling to unilaterally fund a good at its threshold, and that players prefer to contribute to a public good only if they expect that others are also contributing to the same public good.

CCV consider such a framework, showing that there exists two type of equilibria. First, there exists an equilibrium in which players contribute nothing to any of the public goods. Second, for each of the public goods, there exists equilibria in which the groups provide contributions to that good exactly equal to the threshold, while providing no contributions to any other good. There are $N + 1$ symmetric equilibria: one in which $c_{n,j} = 0$ for all n and j, and one for each good n in which each player contributes $c_{n,j} = \tau/J = 33$ and $c_{m,j} = 0$ for all $m \neq n$.

The threshold public good environment is a coordination game in which players want to contribute to a public good only if they expect that others are also contributing to the same good. Furthermore, the size of the contribution they want to provide depends on the contributions they expect others to provide.

As the number of goods N increases, the coordination problem among donors becomes more challenging. Even if a player expects that others will provide a contribution, it becomes less likely that everyone's contribution will go towards the same good, and more likely that the player's own contribution will be directed to an underfunded good and, therefore, wasted. This mis-coordination problem is the focus of CCV, who argue that additional goods increases the risk of mis-coordinating contributions, making it more likely that players focus on the low-risk strategies that are associated with the no-contribution equilibrium.

When players interact over several periods, there are even more equilibria to consider, but the main insights from the model regarding how adding multiple goods discourages donations continue to hold.

4.2 Allowing delegation

To incorporate delegation into the threshold public good framework, we add to the game an initial stage in which one of the four players, i, is appointed to serve as the intermediary, and then the other players choose how much of their endowments to transfer to player i. Denote player j's transfer by $d_j \in [0, y]$, and let $D = \sum_{j \neq i} d_j$. In the second stage of each period, all four players simultaneously choose how to distribute their endowments across the N public goods and their private account just as they did in the game without delegation; except here their endowments are updated to reflect the first stage transfers.

We consider two versions of the delegation game. In the first, player i faces no restrictions on her allocation of the transfers received from other players. She can direct as much or as little of the funds to her private account as well as to the public good as she chooses. In the second version, player i faces a "destination rule" requiring that any transfer from another player in the first stage be passed along to a public good in the second stage; the transfers cannot be directed to the intermediary's private account.

In the delegation environment with a destination rule, there exists equilibria in which the donors only contribute through the intermediary, who then funds one of the public goods at its threshold. For example, there exist equilibria in which each non-intermediary player provides some transfer d_j to the intermediary, who then contributes $c_{i,n} = 132$ to one of the public goods. When players choose such strategies as part of an equilibrium, there is no need to correctly anticipate which of the other goods the other players are going to contribute to. The non-intermediaries simply choose how much to contribute, and the intermediary then chooses the public good to fund using the groups' contributions. Such equilibria continue to exist in the repeated version of the game.

In the delegation environment with unrestricted transfers, there does not exist equilibria of the non-repeated game in which other players only contribute through the intermediary. The intermediary has an incentive to expropriate contributions for her own use rather than pass along enough transfers to reach a funding threshold. Because of this, in a one-shot game, any equilibrium that involves funding a public good entails players coordinating direct contributions on the same good. Some moderate amount of delegation may exist in equilibrium, but not to the extent that it simplifies the coordination problem among donors; it does not eliminate the need to anticipate where others will contribute as part of equilibrium.

In the repeated version of the delegation game with unrestricted transfers, delegation can be more helpful. This is because the presence of repeated interactions between the same set of players allow them to play conditional strategies, which can introduce the potential threat that players will stop contributing to any public good after an intermediary acts outside of the groups' interests. Using such strategies, one may construct equilibria in which non-intermediaries provide contributions only through the intermediary, except for in the last periods of play when players don't need the intermediary to coordinate if they simply continue to fund the same good that was funded in the previous periods. Although delegation can help groups reduce the risk of contributing to different goods in the repeated environment, this requires more complex conditional strategies than in the presence of a delegation rule.

4.3 Testable predictions

The theoretical analysis (see Online Appendix A) provides several predictions that help guide the experimental analysis.

In the multiple public good environment without delegation, CCV showed that players often focused on less-risky strategies. As the risk of mis-coordination increased, players were more likely to play the least risky strategy and contribute nothing to any of the public goods. In the above discussion, we considered how delegating contributions through an intermediary changes the risk of providing contributions.

Delegating contributions can reduce the risk that a donor effectively wastes his contribution by contributing to a different good than other donors. This reduction in risk is likely to increase the probability that players provide contributions (through an intermediary), which in turn increases the probability that a public good reaches its funding threshold.

At the same time, however, delegating contributions can increase the risks that the intermediary redirect money away from public good funding for her private gain. This is a possibility in the game with unrestricted delegation, but not in the environment with a destination rule. Although the theory shows that delegation can exist as part of equilibrium in both environments, the strategies involved in such equilibria are much more complicated in the game with unrestricted delegation than in the game with a destination rule, as conditional strategies and dynamic incentives are required to reduce the risk that the intermediary expropriates transfers.

These insights suggest that the probability that a public good succeeds will be higher in the game with delegation and a destination rule than in either the game without delegation or the game with unrestricted delegation. The theory does not provide clear predictions regarding the comparison of outcomes in the game without delegation and the game with unrestricted delegation. Compared to the multiple public good framework without delegation, unrestricted delegation reduces the risks associated with contributing on one dimension, while introducing a new risk on another dimension. Whether contributions and donor coordination increase or decrease in the game with unrestricted delegation will depend on whether the risk of mis-coordination or the risk of intermediary expropriation are viewed as more significant concerns for donors. This is an empirical question, which we consider in the experimental analysis below.

5 Experimental results

In the first part of the section, we focus our attention on the treatments with multiple public goods: *NoDel*, *Del*, and *DelRule*. We explore differences across treatments in overall contributions, coordination, the delegated amount, and delegation behavior. In the last part of the section, we discuss results from the three analogous treatments with a single public good, *NoDel*[1], *Del*[1], and *DelRule*[1], to investigate how the effects of delegation are mediated by multiplicity of public goods.

In the statistical analysis, we use both non-parametric and parametric techniques. The non-parametric tests are based on independent observations at the group level. Moreover, when looking at differences across treatments over all periods, we will also discuss results from the bootstrap-based methodology developed by List et al. (2019) to test multiple null hypotheses simultaneously in experimental settings with multiple treatments.

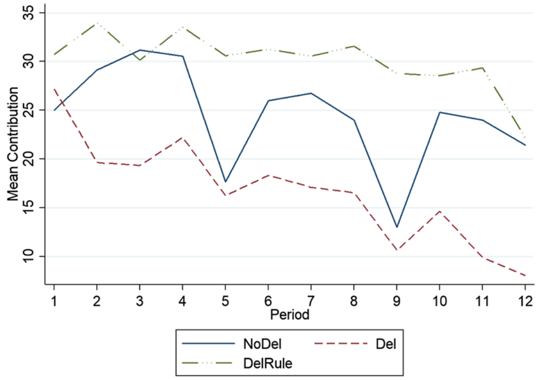


Fig. 1 Total contributions with multiple collective accounts, by treatment and period

Concerning the parametric analysis, in order to account for potential dependence across periods, the estimated coefficients are based on standard errors clustered at the group level.

5.1 Total contributions

Figure 1 shows the mean total contributions to the collective accounts over periods in *NoDel*, *Del* and *DelRule*.

Averaging over all periods, subjects contribute 24.46 tokens in *NoDel*, 16.66 in *Del*, and 30.01 tokens in *DelRule*. Contributions in *NoDel* are placed between those in *Del* and *DelRule* and are characterized by higher volatility across periods. Downward peaks in total contributions observed in the *NoDel* treatment occur in the reshuffling periods (1, 5, and 9) and are followed by sustained contributions in the next three periods, suggesting that moderate contributions in reshuffling periods enable groups to coordinate higher contributions in the following three repetitions.

Table 1 reports results from parametric, random effects panel regressions to assess the statistical relevance of these preliminary observations.

Column (1) compares contributions in *NoDel* with those observed in *Del* and *DelRule* to assess the effects of delegation in a setting characterized by multiple collective accounts. The negative and significant ($p < 0.05$) coefficient of the treatment dummy *Del* indicates that introducing delegation with no destination rule is detrimental for cooperation, as it reduces contributions relative to the baseline treatment with no delegation, *NoDel*. Instead, delegation seems to stimulate contributions in *DelRule*, when the intermediary is subject to the destination rule. The difference in contributions between *DelRule* and *Del* is positive and highly significant ($p < 0.001$), while the difference between *DelRule* and *NoDel*, although positive, does not reach statistical significance ($p = 0.150$). These results are confirmed by non parametric tests. According to a (two-sided) Mann–Whitney rank-sum test, mean (over all periods) total contributions in *Del* are significantly lower than those in *DelRule* ($p < 0.001$) and *NoDel* ($p < 0.05$), while no difference is detected between *DelRule* and *NoDel* ($p = 0.311$). When accounting for multiple null hypotheses testing, the difference in contributions between the two treatments

Table 1 Total contributions with multiple collective accounts: parametric analysis

Total contributions	(1)	(2)		(3)	(4)	(5)	(6)	(7)
		Double hurdle model						
		Int. mar.	Ext. mar.			*NoDel*	*Del*	*DelRule*
Del	− 7.800**	67.535*	− 0.843***	− 8.176**	− 8.736*			
	(3.919)	(38.325)	(0.279)	(3.384)	(5.045)			
DelRule	5.639	149.179***	− 0.629***	3.392	3.563			
	(3.919)	(42.978)	(0.225)	(3.427)	(5.255)			
Coord(*t* − 1)				7.523***	7.867**			
				(1.868)	(3.195)			
Del ∗ *Coord*(*t* − 1)					1.684			
					(4.608)			
DelRule ∗ *Coord*(*t* − 1)					− 2.623			
					(4.571)			
Trend				− 0.975***	− 1.045**	− 0.791***	− 1.007 **	− 0.434
				(0.232)	(0.408)	(0.180)	(0.451)	(0.693)
Del ∗ *Trend*					0.010			
					(0.576)			
DelRule ∗ *Trend*					0.252			
					(0.574)			
*d*1						− 6.281***	4.577	− 2.743
						(1.907)	(4.773)	(7.333)
*d*5						− 10.463***	− 2.369	− 1.105
						(1.661)	(4.158)	(6.388)
*d*9						− 11.937***	− 3.953	− 1.217
						(1.709)	(4.279)	(6.573)

Table 1 (continued)

Total contributions	(1)	(2)		(3)	(4)	(5)	(6)	(7)
		Double hurdle model						
		Int. mar.	Ext. mar.			*NoDel*	*Del*	*DelRule*
*d*12						− 1.146	− 3.502	− 6.569
						(1.930)	(4.832)	(7.422)
cons	24.457***	− 154.733*	0.472**	27.368***	27.657***	31.295***	22.631***	33.451***
	(2.771)	(87.797)	(0.201)	(2.843)	(3.479)	(3.331)	(3.889)	(4.442)
ll	− 13,055.40	− 7832.047		− 11,950.55	− 11,950.00	− 3542.40	− 4279.61	− 4629.27
$Wald - \chi^2$	11.86	12.76		50.62	52.25	119.17	19.91	2.49
$p > \chi^2$	0.003	0.002		0.000	0.000	0.000	0.001	0.777
Obs.	2592	2592		2376	2376	864	864	864

This table parametrically analyzes the determinants of total contributions in *NoDel*, *Del*, and *DelRule*. Columns (1), (3), (4), (5), (6), and (7) report coefficient estimates (standard errors in parentheses) from two-way linear random effects models accounting for both potential individual dependency over periods and dependency within group. The dependent variable is the total contributions made by the subject to the twelve collective accounts in the period. Columns (1), (3) and (4) report results by pooling data from *NoDel*, *Del*, and *DelRule*. Columns (5), (6), and (7) consider data from each treatment, separately. Column (2) report estimates of the intensive and extensive margins (with standard errors clustered at the group lelvel) from a double hurdle model. *Coord*$(t-1)$ is a dummy that assumes value 1 if subject's group reached the threshold on one collective account in the previous period; *Trend* is a linear time trend that starts from 0; *Del* and *DelRule* are treatment dummies; *Del* ∗ *Trend*, *DelRule* ∗ *Trend*, *Del* ∗ *Coord*$(t-1)$, *DelRule* ∗ *Coord*$(t-1)$ are interaction terms. $d1$, $d5$, $d9$, and $d12$ are period dummies that assume value 1 in periods 1, 5, 9, and 12, respectively. Significance levels are denoted as follows: $^{*}p < 0.1$, $^{**}\ p < 0.05$, and $^{***}p < 0.01$

with delegation, *Del* and *DelRule*, remains highly significant ($p = 0.003$), while that between *Del* and *NoDel* reaches only marginal significance ($p = 0.095$).

Result 1 Delegation is detrimental for contributions when it is not sustained by the destination rule. Indeed, subjects make significantly larger total contributions in *DelRule* and *NoDel* than in *Del*.

Column (2) investigates the previous result by reporting estimates of the intensive (namely, the part of the treatment effect that concerns the level of the contribution, conditional on the subject choosing to contribute) and extensive (the part of the treatment effect that is attributable to the subject choosing to contribute) margins of delegation in *Del* and *DelRule*, relative to the treatment with no delegation, *NoDel*. Although the numerical value of the estimates are not directly interpretable, their sign and significance level provide further insight that complements Result 1. In particular, conditional on choosing to contribute, contributions are significantly higher in *DelRule* than in *NoDel* ($p = 0.001$). Also contributions in *Del* are higher than in *NoDel*, although in this case the difference reaches only marginal significance ($p = 0.078$). Moving to the extensive margins, we find that subjects are less likely to make positive contributions in treatments with delegation (for *Del*, $p = 0.003$; for *DelRule*, $p = 0.005$).[10] As it will be discussed in the next sections, in *Del* this result effectively captures the inability of subjects to cooperate and coordinate over collective accounts. Instead, in *DelRule* the result is due to the large amount that subjects choose to transfer to the delegate, a fact that is further confirmed by the high probability to reach the threshold and the high earnings of subjects documented in this treatment. Column (3) shows how results in column (1) change when controlling for the past ability of the group to reach the threshold and adding a time trend. The coefficient of $Coord(t-1)$ is positive and highly significant ($p < 0.001$) suggesting that total contributions increase when the group successfully reached the threshold in the previous period. Finally, the negative and highly significant coefficient of the time trend confirms the existence of a decaying pattern in contributions, as highlighted by Fig. 1. Both the magnitude and significance of the differences in contributions across treatments are not substantially affected by the introduction of these two additional covariates: the differences between *DelRule* and *Del* or between *NoDel* and *Del* remain positive and significant (for the two comparisons, $p < 0.001$ and $p < 0.001$, respectively), while the difference between *DelRule* and *NoDel* is not significant ($p = 0.322$).

Column (4) replicates the analysis in column (3) by adding a number of interaction terms to control for (potential) heterogeneous effects of the linear trend and the past successful provision across treatments. As shown by the results, all the interaction terms are not significant, suggesting that, relative to the baseline, we do not detect significant differences in the effects of the covariates between *Del* and *DelRule*.[11]

[10] Indeed, descriptive statistics suggest that the proportion of subjects contributing nothing to the collective accounts is 31.83% in *NoDel*, 64.47% in *Del*, and 56.25% in *DelRule*.

[11] We also detect no difference between *Del* and *DelRule* when performing formal tests to compare the interaction terms for the difference between $Del * Trend$ and $DelRule * Trend$: $p = 0.671$;

We also investigate the relationship between (self-reported) risk tolerance and contributions. In the post experimental questionnaire, subjects answered the “general risk question” validated by Dohmen et al. (2011): “How willing are you to take risks, in general?”, with Respondents answering on a scale from 0 (not willing at all) to 10 (very willing). Then, we include the risk tolerance and corresponding treatment interactions as additional covariates in columns (1) and (4) of Table 1.[12] We find that risk tolerance significantly increases contributions in *NoDel* only ($p = 0.036$ in the extended version of column 1 and $p = 0.030$ in the extended version of column 2), while it exerts no significant effects in *Del* ($p = 0.678$ in the extended version of column 1 and $p = 0.657$ in the extended version of column 2) as well as in *DelRule* ($p = 0.136$ in the extended version of column 1 and $p = 0.190$ in the extended version of column 2). A possible explanation for this result is that relatively-more risk averse subjects in *NoDel* react to the risk of mis-coordination by reducing their contributions. Instead, delegation in Del and *DelRule* represents a form of insurance against mis-coordination and, therefore, neutralizes the relationship between risk attitude and contributions.

Columns (5), (6), and (7) focus on each of the three treatments, separately. We are mainly interested in assessing whether the three treatments differ from each other in the decaying pattern and the effects of reshuffling the efficient collective accounts. In order to properly identify the effects of reshuffling, for each treatment, we modify the specification in column (3) by adding dummies for periods 1, 5, 9, separately. We also include a dummy for period 12 to look at potential ending game effect. Finally, we exclude $Coord(t-1)$ from the three regressions in order to identify the effect of period 1.

Concerning the effects of the time trend, we find that contributions significantly decline over repetitions in *NoDel* ($p < 0.001$) and *Del* ($p < 0.05$), while they do not exhibit any particular time pattern in *DelRule* ($p < 0.531$).

Every four periods, the four efficient public goods were randomly reshuffled. As highlighted by Fig. 1, the effect of reshuffling is strong in *NoDel*, where subjects cannot use delegation to solve the coordination problem. Indeed, in this treatment, total contributions substantially fall in periods 1, 5 and 9 (for all dummies: $p < 0.001$). In *Del* and *DelRule*, reshuffling does not have any significant effect on contributions.

Result 2 Delegation attenuates the negative effects of reshuffling the relative efficiency of the public goods on total contributions. Moreover, contributions decline more rapidly in *Del* than in *DelRule* or *NoDel*.

In a similar experimental setting characterized by multiple threshold collective accounts, CCV showed that subjects prefer to contribute to the most efficient alternatives, even when the inefficient collective account is salient and might represent

Footnote 11 (continued)
for the difference between $Del * Trend$ and $DelRule * Trend$: $p = 0.671$; for the difference between $Del * Coord(t-1)$ and $DelRule * Coord(t-1)$: $p = 0.355$.

[12] Detailed results are available upon request. We thank an anonymous Referee for this interesting observation.

Table 2 Contributions to efficient and inefficient alternatives with multiple collective accounts

Period	1	1–4	5	5–8	9	9–12	12	All
NoDel								
Eff. pgs	18.560	26.343	11.524	20.193	8.772	18.183	19.472	21.573
	(6.327)	(11.699)	(7.453)	(13.453)	(9.329)	(15.321)	(17.901)	(12.810)
I neff. pgs	0.516	0.188	4.319	2.701	2.806	2.264	1.972	1.718
	(1.945)	(0.519)	(6.894)	(7.512)	(8.034)	(8.336)	(8.367)	(5.243)
Diff.	18.044***	26.155***	7.205***	17.492***	5.966**	15.919***	17.500***	19.855***
Del								
Eff. pgs	21.998	19.441	12.767	15.625	8.399	9.674	6.684	14.913
	(16.336)	(14.565)	(15.889)	(14.504)	(12.698)	(12.486)	(12.959)	(12.387)
Ineff. pgs	0.425	0.154	2.488	0.644	0.479	0.290	0.625	0.363
	(0.857)	(0.273)	(6.832)	(1.704)	(1.285)	(0.674)	(2.358)	(0.667)
Diff.	21.573***	19.287***	10.279**	14.981***	7.920***	9.384***	6.059**	14.550***
DelRule								
Eff. pgs	25.285	27.935	26.222	28.426	26.806	24.944	17.396	27.102
	(12.639)	(8.841)	(12.737)	(8.944)	(11.999)	(10.674)	(15.245)	(8.419)
I neff. pgs	1.303	1.120	0.666	0.318	1.264	1.110	1.940	0.850
	(2.857)	(2.650)	(2.062)	(0.752)	(4.713)	(1.761)	(4.875)	(1.267)
Diff.	23.982***	26.815***	25.556***	28.108***	25.542***	23.834***	15.456***	26.252***
Obs. (per treat)	18	18	18	18	18	18	18	18

This table reports the mean contributions (standard deviations are reported in parentheses) to efficient and inefficient collective accounts in *NoDel*, *Del*, *DelRule*, over periods the table shows significance levels from a (two-sided) Wilcoxon signed-rank test for the null hypothesis that the difference between the contribution to the efficient and inefficient options is null. Significance levels are denoted as follows: $*p < 0.1$, $**p < 0.05$, and $***p < 0.01$

a coordination device. The tendency to opt for efficient collective accounts finds further empirical support in the present paper. Table 2 reports the mean contribution to efficient and inefficient collective accounts in *NoDel*, *Del*, and *DelRule*, over periods.[13] According to a (two-sided) Wilcoxon signed-rank test, the mean contribution to the efficient collective accounts is, over all periods, substantially higher than that to the inefficient alternatives in all treatments ($p < 0.01$). A more detailed look at differences in contributions to the efficient public goods across treatments reveals a positive and significant difference between *DelRule* and *Del* (according to a two-sided Mann–Whitney rank-sum test, $p < 0.001$) as well as between *NoDel* and *Del* ($p = 0.0576$), while no significant difference is found when comparing *DelRule* with *NoDel* ($p = 0.486$).[14]

[13] The mean contributions to the efficient (inefficient) collective accounts in a period is given by the ratio between the total contributions to the efficient (inefficient) alternatives and the number of efficient (inefficient) collective accounts to which, in that period, the subject allocated strictly positive amounts.

[14] The same ranking holds true when focusing on total contributions are taken into consideration. Finally, due to the small magnitude, we do not analyze differences across treatments in the amount contributed to the inefficient public goods.

Result 3 With multiple public goods, subjects contribute substantially more to more-efficient goods than to less-efficient alternatives.

5.2 Successful provision of collective accounts

We now consider the ability of groups to coordinate contributions on the same public good and successfully reach the required threshold. As discussed in the theoretical section, delegation may reduce the risk of donor coordination. It allows group members to centralize the choice of allocating the group's resources across collective accounts on the intermediary. Table 3 reports the mean proportions of successful provision in *NoDel*, *Del*, and *DelRule*, over periods.

Over all periods, *DelRule* is the treatment with the highest percent (66.2%) of groups contributing at or above the threshold of one of the collective accounts, followed by *NoDel* (39.4%) and *Del* (29.6%). According to a Mann–Whitney rank-sum test (two-sided), the mean proportion of periods a group reaches the threshold is significantly higner in *DelRule* than in either *NoDel* ($p = 0.014$) or *Del* ($p = 0.003$). Statistical significance of the differences is confirmed when accounting for multiple null hypotheses testing, as the difference in proportions between *DelRule* and *Del* or *NoDel* remain highly significant (respectively, for the two comparisons: $p = 0.006$ and $p = 0.021$), while the difference between *Del* and *NoDel* is not significant ($p = 0.369$).

Thus, delegation leads to greater coordination only in *DelRule*, where the intermediary is constrained by the destination rule to contribute at least as much as she receives from the rest of the group.

Result 4 With multiple collective accounts, delegation increases the ability of the group to successfully reach the threshold of a collective account only when the intermediary's behavior is limited by the destination rule.

5.3 Subjects' earnings

We now look at how previous results translate into differences in subjects' earnings across treatments. Figure 2 shows the mean earnings over periods in *NoDel*, *Del* and *DelRule*.

Averaging over all periods, subjects earn 133.40 points in *NoDel*, 128.07 points in *Del*, and 162.13 points in *DelRule*. Again, we observe a large variability in earnings in *NoDel*, with downward peaks occurring in the reshuffling periods (1, 5 and 9) when coordination is more difficult to achieve, and upward peaks reached in the subsequent three periods. Again, a plausible interpretation of this pattern is that subjects use (moderate) contributions in the reshuffling periods as a signal to achieve coordination in subsequent rounds. The highest earnings are registered in *DelRule*, where group members are more successful in coordinating and contributing above the threshold.

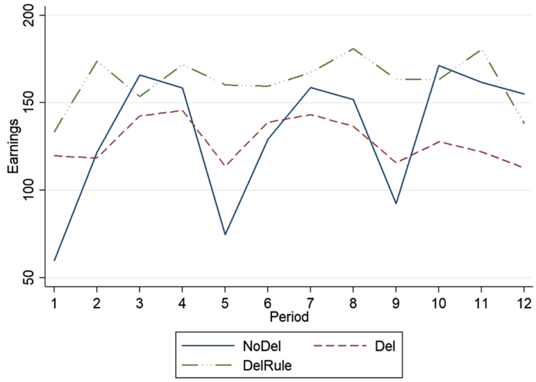
These initial observations are formally investigated in Table 4, which shows the mean earnings in *NoDel*, *Del* and *DelRule*.

Table 3 Mean proportion of successful provision with multiple collective accounts

Period	1	1–4	5	5–8	9	9–12	12	All
NoDel	0.000	0.389	0.000	0.361	0.056	0.431	0.500	0.394
	(0.000)	(0.115)	(0.000)	(0.113)	(0.054)	(0.117)	(0.118)	(0.115)
Del	0.389	0.375	0.222	0.333	0.167	0.181	0.111	0.296
	(0.115)	(0.114)	(0.098)	(0.111)	(0.088)	(0.091)	(0.074)	(0.108)
DelRule	0.500	0.653	0.667	0.694	0.667	0.639	0.444	0.662
	(0.118)	(0.112)	(0.111)	(0.109)	(0.111)	(0.113)	(0.117)	(0.111)
NoDel−Del	− 0.389***	0.014	− 0.222**	0.028	− 0.111	0.250**	0.389**	0.098
NoDel−DelRule	− 0.500***	− 0.264**	− 0.667***	− 0.333***	− 0.611***	− 0.208*	0.056	− 0.268**
Del−DelRule	− 0.111	− 0.278**	− 0.445***	− 0.361***	− 0.500***	− 0.458***	− 0.333**	− 0.366***
Obs. (*per treat*)	18	18	18	18	18	18	18	18

This table reports mean proportions (standard errors of the proportions are reported in parentheses) of successful provision – namely, reaching the threshold of one collective account – over periods in *NoDel*, *Del*, and *DelRule*. The table also shows significance levels from a nonparametric (two-sided) Mann–Whitney rank-sum test for the null hypothesis that the proportion in two treatments is the same. The other remarks of Table 2 apply

Fig. 2 Subjects' earnings with multiple collective accounts, by treatment and period



Over all periods, according to a Mann–Whitney rank-sum test (two-sided), the difference between *DelRule* and both *NoDel* and *Del* are significant ($p = 0.034$ and $p = 0.011$, respectively). Again, differences remain significant when accounting for multiple null hypotheses testing (for the difference between *DelRule* and *NoDel*, $p = 0.031$; for the difference between *DelRule* and *Del*, $p = 0.023$). The difference between *Del* and *NoDel* is non significant using either a standard Mann–Whitney rank-sum test ($p = 0.874$) or when accounting for multiple null hypotheses testing ($p = 0.650$), suggesting that the lower contributions in *Del* do not necessarily lead to lower average payoffs.

We also consider how mean earnings differ from 110, the payoff associated with the no-contribution equilibrium. Only in *DelRule* do subjects earn significantly more than what they could get by entirely allocating the endowment in the private account, according to a (two-sided) Wilcoxon signed-rank test ($p < 0.001$). In the other two treatments, although the difference between earnings and 110 is positive, it is only marginally significant (in *NoDel*: $p = 0.078$; in *Del*: $p = 0.061$). In the reshuffling periods of *NoDel*, the difference is negative and highly significant (in period 1, $p < 0.001$; in period 5, $p < 0.001$; in period 9, $p = 0.006$). Thus, delegation, if sustained by the destination rule, stimulates cooperation among group members and increases their earnings.

Result 5 With multiple collective accounts, delegation is profitable and significantly increases subjects' earnings only when it is sustained by the destination rule.

In our experiment, delegation does not impose any administrative cost on group members. However, in the real world, administrative and fundraising costs can be high and undermine the potential coordination benefits documented in our experiment.[15] For instance, according to data made public online,[16] the U.S. United Way network's administration/overhead rate is around 14.5%, very competitive with the nation's top 100 nonprofits. Moreover, it is well below industry standards and recommendations (like the 25% rate suggested by the Office of Personnel Management).

[15] We thank an anonymous Referee for this important observation.

[16] See the section "Where does the money go?" at https://www.unitedway.org/contact-us/faqs.

Table 4 Subject's earnings with multiple collective accounts

Period	1	1–4	5	5–8	9	9–12	12	All
NoDel	59.972	126.444	74.667	128.611	92.444	145.132	154.944	133.396
	(23.628)	(47.307)	(24.622)	(41.774)	(35.398)	(40.814)	(61.156)	(37.962)
Del	119.750	131.556	113.806	133.104	115.750	119.549	112.667	128.069
	(67.306)	(44.728)	(56.799)	(38.760)	(43.778)	(32.856)	(39.951)	(32.838)
DelRule	133.417	158.125	160.222	166.944	163.361	161.313	138.056	162.127
	(71.841)	(51.259)	(65.399)	(50.889)	(62.320)	(42.6712)	(64.523)	(37.221)
NoDel–110	– 50.028***	16.444	– 35.333***	18.611	– 17.556 ***	35.132**	44.944**	23.296*
Del–110	9.750	21.556	3.806	23.104	5.570	9.549	2.667	18.069*
DelRule – 110	23.417*	48.125***	50.222***	56.944***	53.361***	51.313***	28.056	52.127***
NoDel–*Del*	– 59.778***	– 5.112	– 39.139***	– 4.493	– 23.306 **	25.583	42.277*	5.327
NoDel–*DelRule*	– 73.445***	– 31.681*	– 85.555***	– 38.333**	– 70.917***	– 16.181	16.888*	– 28.731**
Del–*DelRule*	– 13.667	– 26.569*	– 46.416*	– 33.840*	– 47.611*	– 41.764**	– 25.389	– 34.058**
Obs. (*per treat*)	18	18	18	18	18	18	18	18

This table reports mean earnings (standard deviations are reported in parentheses) over periods in *NoDel*, *Del*, and *DelRule*. For each treatment, the table reports results of a (two-sided) Wilcoxon signed-rank test for the null hypothesis that earnings are equal to 110, namely the level that is associated with the zero contribution equilibrium. Finally, the table shows results from a nonparametric (two-sided) Wilcoxon rank sum test for the null hypothesis that the mean earnings in two treatments are the same. The other remarks of Table 2 apply

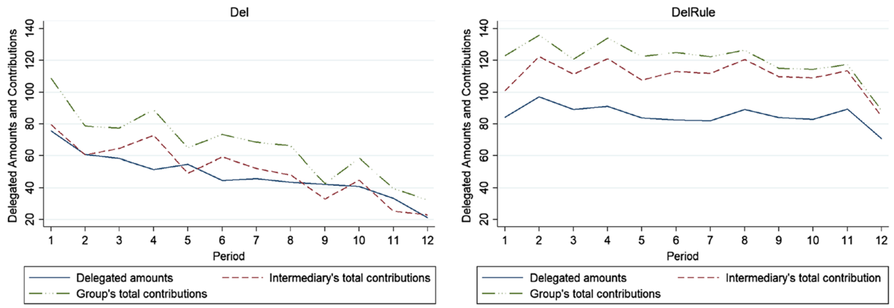


Fig. 3 Delegated amounts and intermediary's total contributions with multiple collective accounts, by treatment and period

Given the results in Table 4, it follows that, over all periods, subjects' earnings in *DelRule* are 21.54% larger than in *NoDel*, thus suggesting that, in order to nullify the social benefits of delegation, administrative costs should amount to (at least) 21.54%.

We also parametrically compare the effect of delegation on earnings with the benchmark administrative costs. In particular, in the online Appendix (Table A.1) we report results from the same econometric specification undertaken in column (1) of Table 1, but using the individual earnings as dependent variable and including two interactions to account for differences in earnings between the delegate and non delegated subjects in *Del* and *DelRule*. In addition, since the main effect on earnings are observed in the reshuffling periods, we replicate the same regression by including data on periods 1, 5, and 9, only. Our interest focuses on the difference in profits when comparing the delegate in *DelRule* with the generic subject in *NoDel*. Over all periods, the increase in profits of the delegate are 28.66%, large enough to compensate both the benchmark administrative costs of 14.5% ($p = 0.176$) and 25% ($p = 0.727$). Moreover, relative to *NoDel*, even the non delegated subjects register a (substantial) increase of 19.16% in their earnings ($p < 0.001$). Thus, delegation in *DelRule* produces and increase in welfare that goes well above the benchmark administrative costs.

The results are even stronger when focusing in the reshuffling periods, namely when coordination of donors is much harder to achieve and the intermediaries play a larger role in potentially coordinating contributions. Indeed, in this case, relative to *NoDel*, the increase in earnings in *DelRule* are 94.21% for a non delegated subject and 122.36% for the delegate, being the change for the latter category substantially higher than benchmark administrative costs (in both cases, $p < 0.001$).

5.4 Delegated amounts and contributions

The previous results suggest that, in *DelRule*, delegation may help groups coordinate on a public good and increase their expected payoffs.

Figure 3 shows the amounts delegated by the group members to the intermediary, as well as her total contributions to the collective accounts in *Del* and *DelRule*.

Three important observations emerge from Fig. 3. First, the amounts transferred by group members to the intermediary are higher in *DelRule* than in *Del*. Over all periods, the mean delegated amounts are 85.44 tokens in *DelRule* and 47.69 tokens in *Del*, respectively. Second, while the intermediary contributes more than what is transferred by the group in *DelRule*, there is no substantial difference between delegated amounts and the intermediary's total contributions in *Del*. Over all periods, the difference between the intermediary's total contribution and the delegated amounts is 24.99 in *DelRule* and 3.27 in *Del*. Third, both the delegated amounts and the intermediary's total contributions substantially decay over repetitions in *Del*, but remain stable in *DelRule*.

Table 5 reports descriptive statistics on the delegated amounts and the intermediary's total contributions in *Del* and *DelRule* over all periods, together with results from non-parametric tests.

Over all periods, both the delegated amounts and the intermediary's total contributions are substantially higher in *DelRule* than in *Del*. According to a Mann–Whitney rank-sum test (two-sided), the differences between *Del* and *DelRule* in both variables are highly significant (for the delegated amounts: $p < 0.001$; for the intermediary's total contributions: $p < 0.001$). These results remain highly significant when accounting for multiple null hypotheses testing (for both the delegated amounts and the intermediary's total contributions: $p < 0.001$).

Next, we compare the intermediary's total contributions with the transfers received from the group members in the first stage. In *DelRule*, the intermediary contributes substantially more than the delegated amounts, while no remarkable differences are detected in *Del*. Indeed, over all periods, the difference between the intermediary's total contribution and the delegated amounts in *DelRule* is 24.99 tokens (around 29% of what is transferred by the group) and highly significant according to a (two-sided) Wilcoxon signed-rank test ($p < 0.001$). In *Del* the difference drops to 3.27 tokens and is not significantly different from zero ($p = 0.617$).[17]

Result 6 With multiple collective accounts, the destination rule increases the amount transferred by the group members in the delegation phase. Moreover, in *DelRule*, the intermediary's total contributions are on average 29.25% higher than the total amount delegated by the members of the group.

The previous result does not take into account the difference in the proportion of successful groups between *DelRule* and *Del* (Result 4). In order to better understand the interplay between the intermediary's total contribution and the

[17] We also investigate whether the intermediary contributes out of her own wallet (namely, net of the delegated resources) more than what, on average, other group members invest (namely, the sum between the resources transferred to the intermediary in the first phase and the amount contributed in the second phase) in the two phases of the experiment. We find that, in both treatments with delegation, the intermediary contributes out of her own wallet less than what invested by any of the other group members, with the difference being substantially bigger in *Del* than in *DelRule*. Indeed, over all periods, the intermediary contributes out of her wallet, 3.274 in *Del* and 24.991 in *DelRule*, while the investment of any other group member is 21.119 in *Del* and 31.798 in *DelRule*. The difference between intermediary's contribution and the average investment of the other group members is highly significant in *Del* ($p < 0.001$) and significant in *DelRule* ($p = 0.012$).

Table 5 Delegated amounts and intermediary's total contributions with multiple collective accounts

Period	1	1–4	5	5–8	9	9–12	12	All
Int.'s cont.								
Del	79.444	69.319	49.111	52.111	32.944	31.472	22.944	50.968
	(60.361)	(50.750)	(59.726)	(48.825)	(53.822)	(37.327)	(39.867)	(40.734)
DelRule	100.778	113.861	107.556	113.208	109.722	104.236	84.778	110.435
	(43.821)	(31.253)	(44.231)	(7.506)	(40.439)	(41.231)	(53.743)	(34.547)
Del–DelRule	− 21.334	− 44.542**	− 58.445***	− 61.097***	− 76.778***	− 72.764***	− 61.834***	− 59.467***
Del.Am.								
Del	75.667	61.569	54.833	47.153	42.222	34.361	21.167	47.694
	(26.677)	(2.430)	(37.477)	(32.584)	(35.512)	(27.611)	(27.391)	(28.818)
DelRule	84.222	90.347	83.722	84.278	84.000	81.708	70.667	85.444
	(37.060)	(26.489)	(33.897)	(29.721)	(30.506)	(31.913)	(43.013)	(26.926)
Del–DelRule	− 8.555	− 28.778***	− 28.889**	− 37.125***	− 41.778***	− 47.347***	− 49.500***	− 37.750***
Int.'s cont.–Del.Am.								
Del	3.777	7.750	− 5.772	4.958	− 9.278	− 2.934	1.777	3.274
DelRule	16.556***	23.514***	23.834***	28.930***	25.722***	22.528***	14.111***	24.991***
Obs. (*per treat*)	18	18	18	18	18	18	18	18

This table reports means (standard deviations are reported in parentheses) of both the delegated amounts and intermediary's total contributions over periods in *Del* and *DelRule*. The table also shows results from a nonparametric (two-sided) Wilcoxon rank sum tests for the null hypotheses that the mean delegated amounts and the intermediary's mean contributions in the two treatments are the same. Finally, for each treatment, the table reports results of a (two-sided) Wilcoxon signed-rank test for the null hypothesis that the delegated amounts are equal to the intermediary's total contributions. The other remarks of Table 2 apply

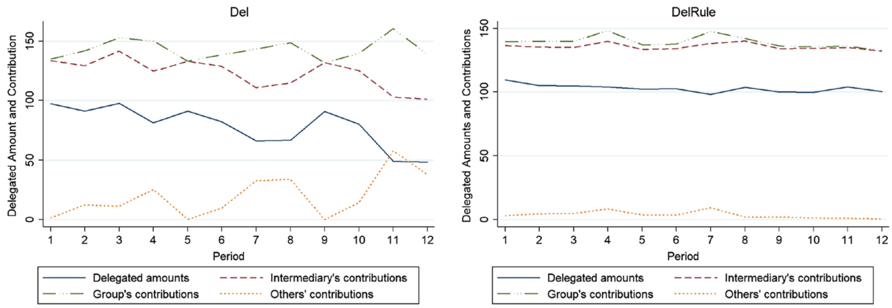


Fig. 4 Delegated amounts and contributions to the financed collective account in successful groups with multiple alternatives, by treatment and period

delegated amounts, we now focus on groups that successfully reached the threshold of a collective account. For these groups, Fig. 4 shows the delegated amounts, the intermediary's contributions, the contributions made by the other three group members, and the group's aggregate contributions to the financed collective account over all periods in *DelRule* and *Del*.

The figure provides a number of interesting insights. First, in contrast to Fig. 3, we document no substantial difference between *Del* and *DelRule* in the group's aggregate contributions, settling in both treatments around 140 tokens. Second, successful groups transfer more resources to the intermediary in *DelRule* than in *Del*, a result that confirms what was reported in Result 6. Third, when focusing on successful groups, we document a positive difference between the intermediary's contributions and the delegated amounts in both treatments, with its size being somewhat bigger in *Del* than in *DelRule*. Table 6 formally investigates the validity of the previous graphical observations.

According to a (two-sided) Mann–Whitney rank-sum test, over all periods, there are no significant differences in group's aggregate contributions to the financed collective account between *Del* and *DelRule* ($p = 0.493$). Nevertheless, we document notable differences in the way in which delegation is used in the two treatments. First, the presence of the destination rule significantly increases the groups' willingness to transfer money to the intermediary (for the difference in the delegated amounts between *Del* and *DelRule*, $p = 0.002$). Second, in order to reach the threshold and due to the difference in the delegated amounts, the intermediary contributes a larger share of her own endowment in *Del* than in *DelRule* ($p = 0.014$). A reasonable explanation of this result is that, by preventing expropriation by the intermediary, the destination rule stimulates delegation and, therefore, reduces the necessity of the intermediary to use their own money to reach the threshold.

Result 7 With multiple collective accounts, the destination rule makes delegation more effective within successful groups: it increases the delegated amounts and reduces the necessity for the intermediary to use her own endowment to reach the threshold.

Table 6 Delegated amounts and contributions in successful groups with multiple collective accounts

Period	1	1–4	5	5–8	9	9–12	12	All
Group′s cont.								
Del	135.000	143.764	133.250	142.242	132.000	141.000	139.000	141.807
	(4.546)	(16.024)	(1.258)	(9.502)	(0.000)	(9.716)	(5.657)	(9.450)
DelRule	139.667	143.026	137.167	141.859	136.333	135.794	132.625	139.915
	(9.526)	(13.184)	(6.978)	(15.315)	(8.223)	(6.795)	(0.916)	(8.817)
Del−DelRule	− 4.667	0.738	− 3.917	0.383	− 4.333*	5.206	6.375* *	1.892
Del. am.								
Del	97.286	87.194	91.250	71.017	90.667	72.125	48.500	78.701
	(9.526)	(18.395)	(4.573)	(21.6523.2654)	(8.145)	(23.584)	(12.021)	(23.265)
DelRule	109.556	103.099	102.333	100.823	100.250	135.794	100.375	101.940
	(28.566)	(17.607)	(18.297)	(14.726)	(17.284)	(23.584)	(16.578)	(12.038)
Del−DelRule	− 12.270	− 15.905*	− 11.083	− 29.806* * *	− 9.583	− 63.669* * *	− 51.875* *	− 23.239***
Int.′s cont.								
Del	36.286	42.215	41.750	46.075	41.333	45.75	52.500	43.789
	(19.508)	(12.976)	(4.573)	(6.069)	(17.285)	(7.161)	(3.536)	(11.337)
DelRule	27.000	34.526	31.167	36.224	34.000	33.211	31.750	33.792
	(20.316)	(14.054)	(18.150)	(12.625)	(18.061)	(14.468)	(16.611)	(10.672)
Del−DelRule	9.286	7.689	10.583	9.851*	7.333	12.539**	20.750**	9.997**
Others' cont.								
Del	1.429	14.354	0.250	25.150	0.000	23.125	38.000	19.317
	(2.225)	(18.046)	(0.500)	(27.556)	(0.000)	(27.754)	(21.213)	(23.590)
DelRule	3.111	5.401	3.667	4.813	2.083	1.8	0.500	4.182
	(5.510)	(7.762)	(6.372)	(8.223)	(3.232)	(2.834)	(0.926)	(6.210)
Del−DelRule	− 1.682	8.593*	− 3.417	20.337**	− 2.083	21.325	37.500**	15.135*
Obs.	26	28	16	26	15	21	10	30

Table 6 (continued)

This table reports the mean delegated amounts (standard deviations are reported in parentheses), the mean of the group's aggregate contributions, the mean of the intermediary's contributions, and the mean contributions made by the other three non-intermediary group members to the financed collective account in *Del* and *DelRule*, by restricting the attention to successful groups. The table also shows results from a nonparametric (two-sided) Wilcoxon rank sum tests for the null hypotheses that means in the two treatments are the same. The other remarks of Table 2 apply

In the Online Appendix, we investigate differences across treatments and determinants of intermediary's behavior as well as its effect on groups' inclination to cooperate.

First, we show that, over all periods, the proportion of delegates expropriating resources is 36.6% in Del, with the large majority of these cases (86.1%) being associated with full expropriation,[18] and very frequently (81% of the cases) expropriation was an efficient decision because the intermediary did not have enough resources to meet the threshold. The proportion of intermediaries contributing more than what received from the group is substantially larger in *DelRule* (68.5%) than in *Del* (42.6%), with the difference being highly significant according to a proportion test ($p < 0.001$). We also find that both delegate's contributions and the probability of observing crowding-in positively depend on the delegated amounts, with the relationship being particularly pronounced up to the level that allows the intermediary to reach the threshold. The probability of observing the delegate to expropriate resources in *Del* is stimulated by the delegated amounts, although it substantially decreases when the group transfers enough to allow the intermediary to reach the threshold.

Second, concerning the effects of delegate's behavior on groups' cooperation, we find that observing an intermediary expropriating resources in *Del* substantially reduces a group's contributions and the delegated amounts in subsequent periods. On the other hand, in both *Del* and *DelRule*, observing an intermediary's crowding-in does not exert any relevant effect on the group's behavior.

5.5 Treatments with a single collective account

In order to investigate the interplay between delegation and multiplicity of public goods, we run three additional treatments, *NoDel*[1], *Del*[1], and *DelRule*[1], that are analogous to the multiple public good treatments but with only a single collective account to which players may contribute.

With a single collective account, coordination among donors is likely to be easier than in the setting with multiple collective accounts. This is because successfully funding a single public good only requires that subjects contribute enough in total to reach the threshold; there is no risk that subjects contribute enough to reach a threshold, but inefficiently spread their contributions out across different goods. It is this aspect of mis-coordination that delegation most-directly addresses. Therefore, we expect delegation to be potentially less effective at improving donor coordination and payoffs in the single public good environment. At the same time, in the environment with unrestricted delegation, the risk of expropriation by the intermediary is independent of the number of collective accounts. Therefore, we expect that the lack of a destination rule in a delegation environment has a similar detrimental effect on coordination and payoffs with a single public good as it had in the multiple

[18] Namely, the intermediary contributes nothing and entirely expropriates the amounts received from group members.

public good setting. The experimental evidence is generally consistent with these expectations.

Figure 5 shows the mean contributions to the single collective account and the mean earnings over periods in *NoDel*[1], *Del*[1] and *DelRule*[1].

Averaging over all periods, subjects contribute 30.51 tokens in *NoDel*[1], 20.63 in *Del*[1] and 31.22 tokens in *DelRule*[1]. In all periods, contributions in *DelRule*[1] are well above those in *Del*[1], suggesting that even in the setting with a single collective account, the destination rule strongly increases group's overall contributions. No remarkable difference is observed between *NoDel*[1] and *DelRule*[1], while contributions in *Del*[1] are lower than those in the other two treatments.

Table 7 replicates the parametric analysis of Table 1 by using data from the three treatments with a single collective account.

From column (1), and in line with the results in the setting with multiple collective accounts, delegation with no destination rule discourages contributions. Both the differences between *Del*[1] and *NoDel*[1], and between *Del*[1] and *DelRule*[1] are negative and highly significant (in the first case, $p = 0.003$; in the second case, $p = 0.002$). Again, although positive, the difference between *DelRule*[1] and *NoDel*[1] is not significant ($p = 0.277$). These findings are confirmed by non parametric tests. According to a two side Mann–Whitney rank-sum test, mean contributions (over all periods) in *Del*[1] are significantly lower than those in *DelRule*[1] ($p = 0.019$) and *NoDel*[1] ($p = 0.025$), while no difference is detected between *DelRule*[1] and *NoDel*[1] ($p = 0.912$).

Result 8 With a single collective account, subjects make larger contributions in *DelRule*[1] and *NoDel*[1] than in *Del*[1]. There is no significant difference in contributions between *DelRule*[1] and *NoDel*[1].

Concerning the other determinants of individual contributions, column (2) confirms that even in the setting with a single collective, contributions decline over repetitions (the coefficient of *Trend* is negative and highly significant, $p < 0.001$) and positively respond to the group's successful provision in the previous period (the coefficient of $Cood(t-1)$ is negative and highly significant, $p < 0.001$).

Column (3) documents some differences across treatments in the decaying pattern and the effects of past successful provision on contributions. In particular, the interaction term $DelRule[1] * Trend$ is positive and highly significant ($p < 0.01$), suggesting that the linear time trend is less pronounced in *DelRule*[1] than in *NoDel*[1]. Similar conclusions emerge when comparing the coefficient of the linear time trend in *Del*[1] and *DelRule*[1], as the difference between the two interaction terms, $DelRule[1] * Trend$ and $Del[1] * Trend$, is positive and significant ($p = 0.031$). Moreover, *DelRule*[1] is the only treatment in which the linear time trend presents a non significant coefficient (for the linear combination of *Trend* and $Del[1] * Trend$: $p = 0.421$). When looking at the effects of the past successful provision, no difference is detected between *NoDel*[1] and *DelRule*[1] (for the coefficient of $DelRule[1] * Coord(t-1)$: $p = 0.966$), while the effect is

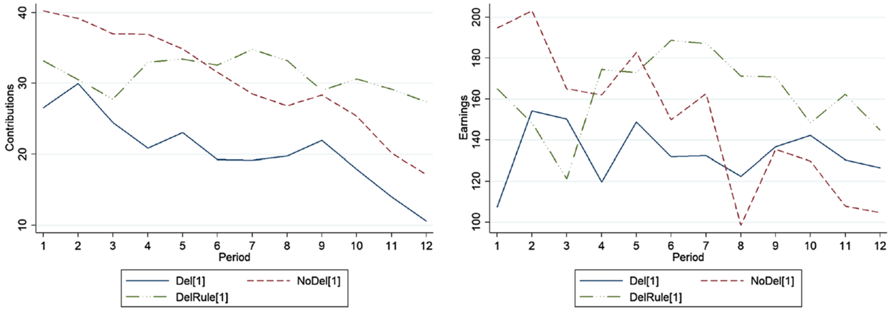


Fig. 5 Contributions and earnings with a single collective account, by treatment and period

significantly stronger in *Del*[1] than in the other two treatments (for the coefficient of $Del[1] * Coord(t-1)$: $p = 0.051$; for the difference between the two interaction terms, $DelRule[1] * Coord(t-1)$ and $Del[1] * Coord(t-1)$, $p = 0.039$).

Here, there is no reshuffling of the efficient collective accounts. The last three columns document no remarkable differences in contributions in periods 1, 5, 9, and 12, thus confirming that the effects documented in the setting with multiple collective accounts can be genuinely attributed to the reshuffling procedure used to select the four efficient collective accounts.[19]

With a single collective account, group members do not face the risk of miscoordinating contributions to different alternatives. Nevertheless, even in the single collective account setting, delegation can potentially stimulate cooperation. For instance, by delegating resources, other group members can signal their intention to cooperate to reach the threshold and trigger the delegate's positive response. We investigate these considerations in Table 8.

over all periods, *DelRule*[1] is associated with the highest percent of successful contribution (63.9%), followed by *NoDel*[1] (53.7%) and *Del*[1] (35.6%). According to a Mann–Whitney rank-sum test (two sided), only the difference between *Del*[1] and *DelRule*[1] is significantly different from 0 ($p = 0.026$). Instead, the other two differences are less pronounced, reaching marginal significance between *NoDel*[1] and *Del*[1] ($p = 0.069$) and being not significant between *NoDel*[1] and *Del*[1] ($p = 0.238$). When accounting for multiple null hypotheses testing, only the difference between *DelRule*[1] and *Del*[1] remains significant ($p = 0.040$). Thus, with a single collective account, delegation is either useless (when comparing *DelRule*[1] with *NoDel*[1]) or detrimental for successful provision of the collective account (when comparing *Del*[1] with *NoDel*[1]).

Result 9 With a single collective account, delegation either reduces group's ability to reach the threshold when there is no destination rule, or it does not have any significant effect when the intermediary's choices are constrained by the destination rule.

[19] Only in *NoDel*[1] and *Del*[1] the coefficient attached to the dummy for period 9 is positive and reaches marginal significance, $p = 0.092$ and $p = 0.073$, respectively.

Table 7 Total contributions with a single collective account: parametric analysis

Total contribution	(1)	(2)	(3)	(4) *NoDel*[1]	(5) *Del*[1]	(6) *DelRule*[1]
Del[1]	− 9.882***	− 7.936***	− 14.481***			
	(3.349)	(2.832)	(4.711)			
DelRule[1]	0.703	0.765	− 8.028*			
	(3.349)	(2.819)	(0.357)			
Coord$(t-1)$		7.937***	5.065*			
		(1.452)	(2.607)			
Del[1] $*$ *Coord*$(t-1)$			7.314*			
			(3.743)			
DelRule[1] $*$ *Coord*$(t-1)$			− 0.152			
			(3.560)			
Trend		− 1.050***	− 1.777***	− 2.018***	− 1.311***	0.053
		(0.187)	(0.357)	(0.184)	(0.276)	(0.593)
Del[1] $*$ *Trend*			0.545			
			(0.479)			
DelRule[1] $*$ *Trend*			1.521***			
			(0.479)			
*d*1				− 1.321	− 1.151	2.018
				(1.950)	(2.926)	(6.284)
*d*5				1.390	0.564	2.057
				(1.699)	(2.549)	(5.474)
*d*9				2.949*	4.710*	-2.571
				(1.748)	(2.623)	(5.633)
*d*12				− 2.191	− 2.691	− 4.354
				(1.974)	(2.961)	(6.360)
cons	30.513***	31.403***	37.404***	41.544***	27.721***	31.162***
	(2.368)	(2.497)	(3.666)	(2.192)	(3.427)	(3.883)
ll	− 12,516.05	− 11,415.19	− 11,407.77	− 3530.07	− 3874.19	− 4500.94
$Wald-\chi^2$	12.49	91.88	109.58	238.20	47.84	1.11
$p>\chi^2$	0.002	0.000	0.000	0.000	0.000	0.953
Obs.	2592	2376	2376	864	864	864

This table replicates the parametric analysis presented in Table 1 by pooling data from *NoDel*[1], *Del*[1], and *DelRule*[1]. *Del*[1] $*$ *Trend*, *DelRule*[1] $*$ *Trend*, *Del*[1] $*$ *Coord*$(t-1)$, *DelRule*[1] $*$ *Coord*$(t-1)$ are interaction terms. The other remarks of Table 1 apply

Moving to earnings, the right panel of Fig. 5 and Table 9 report the mean earnings over periods in *NoDel*[1], *Del*[1] and *DelRule*[1].

Averaging over all periods, subjects earn 149.67 points in *NoDel*[1], 133.58 points in *Del*[1], and 162.93 points in *DelRule*[1]. *Del*[1] exhibits the worst earning performance over periods, confirming the fact that, with a single collective account and no destination rule, delegation undermines cooperation. According to a Mann–Whitney rank-sum test (two-sided), both the difference between *Del*[1]

Table 8 Mean proportion of successful provision with a single collective account

Period	1	1–4	5	5–8	9	9–12	12	All
NoDel[1]	0.833	0.764	0.777	0.542	0.444	0.306	0.167	0.537
	(0.088)	(0.100)	(0.009)	(0.117)	(0.117)	(0.109)	(0.088)	(0.118)
Del[1]	0.278	0.403	0.444	0.347	0.389	0.319	0.222	0.356
	(0.106)	(0.117)	(0.117)	(0.112)	(0.115)	(0.110)	(0.098)	(0.113)
DelRule[1]	0.667	0.583	0.722	0.750	0.667	0.583	0.500	0.639
	(0.111)	(0.116)	(0.106)	(0.102)	(0.111)	(0.116)	(0.118)	(0.113)
NoDel[1]−*Del*[1]	0.555***	0.361***	0.333**	0.195	0.055	– 0.013	– 0.055	0.181*
NoDel[1]−*DelRule*[1]	0.166	0.181**	0.055	– 0.208*	– 0.223	– 0.277**	– 0.333**	– 0.102
Del[1]−*DelRule*[1]	– 0.389**	– 0.180	– 0.278*	– 0.403***	– 0.278*	– 0.264**	– 0.278*	– 0.283**
Obs. (*per treat*)	18	18	18	18	18	18	18	18

This table reports mean proportions (standard errors of the proportions are reported in parentheses) of successful provision – namely, reaching the threshold of one collective account – over periods in *NoDel*[1], *Del*[1], and *DelRule*[1]. The other remarks of Table 3 apply

and *NoDel*[1] as well as the difference between *Del*[1] and *DelRule*[1] are negative, although only the latter case reaches statistical significance (in the first case: $p = 0.146$; in the second case: $p = 0.025$). The difference between *Del*[1] and *DelRule*[1] remains significant when accounting for multiple null hypotheses testing ($p = 0.070$).

Result 10 With a single collective account, delegation is detrimental for subjects' earnings: it either reduces earnings when there is no destination rule, or it does not affect their level when the intermediary's choices are constrained by the destination rule.

In aggregate, the results from the treatments with a single collective account are consistent with our expectations. Delegation with a destination rule is less important for facilitating cooperation in the single public good environment than it is in the multiple public good environment, as evidenced by the smaller differences between the outcomes in *DelRule*[1] and *NoDel*[1] than were previously observed between *DelRule* and *NoDel*. At the same time, the presence of unrestricted delegation in *Del*[1] is detrimental for contributions, coordination and payoffs, just as previously observed in *Del*. The detrimental effects of unrestricted delegation are perhaps even more surprising in the single public good environment than it was with multiple public goods. Subjects could simply ignore the intermediary; any strategies that were possible in the no-delegation environment are also possible in the single public good environment. Although this is also true in the multiple threshold public good environment, the fact that delegation has less benefit may make ignoring delegation a more-salient strategy in the single public good case.[20]

[20] In the online Appendix, we also report results on the delegated amounts and the contributions of the delegate in *Del*[1] and *DelRule*[1]. Even with a single collective account, the destination rule increases the delegated amount and on average induces the intermediary to contribute 37.02% more than what is transferred by the group.

Table 9 Subject's earnings with a single collective account

Period	1	1–4	5	5–8	9	9–12	12	All
NoDel[1]	194.722	181.181	182.778	148.396	135.472	119.444	104.694	149.674
	(67.959)	(53.975)	(65.969)	(50.940)	(77.655)	(38.760)	(47.717)	(38.956)
Del[1]	107.528	132.903	148.917	133.875	136.778	133.951	126.500	133.576
	(71.199)	(44.827)	(68.6179)	(48.768)	(67.894)	(50.393)	(47.717)	(40.147)
DelRule[1]	164.917	152.250	172.917	179.979	170.750	156.563	144.778	162.931
	(74.774)	(35.922)	(71.027)	(40.337)	(64.290)	(48.439)	(74.375)	(33.604)
NoDel[1]−110	84.722***	71.181***	72.778***	38.396***	25.472	19.444	− 5.306	39.674***
Del[1]−110	− 2.472	22.903*	38.917	23.875	26.778	23.951	16.500	23.576
DelRule[1]−110	54.917***	42.250***	62.917***	69.979***	60.750***	46.563***	34.778*	52.931***
NoDel[1]−*Del*[1]	87.194***	48.278***	33.861	14.521	− 1.306	− 14.507	− 21.806	16.098
NoDel[1]−*DelRule*[1]	29.805**	28.931**	9.861	− 31.583*	− 35.278	− 37.119**	− 40.084	− 13.257
Del[1]−*DelRule*[1]	− 57.389*	− 19.347	− 24.000	− 46.104**	− 33.972	− 22.612	− 18.278	− 29.355**
Obs. (*per treat*)	18	18	18	18	18	18	18	18

This table reports mean (standard deviations are reported in parentheses) earnings over periods in *NoDel*[1], *Del*[1], and *DelRule*[1]. The other remarks of Table 4 apply

That unrestricted delegation leads to worse options even when it could easily be ignored suggests that the possibility of delegation increases the perceived risk or strategic complexity associated with contributing directly or through the intermediary. The fact that delegation leads to worse outcomes only in the unrestricted case and not with the destination rule suggests that it is not the increased complication to the strategic setting introduced by delegation that discourages contributions. Instead, the detrimental effects of unrestricted delegation are consistent with an increase in the perceived uncertainty about the contributions of others and the risk of essentially wasting one's contributions by directing them to an otherwise underfunded good that discourage giving.

By comparing contributions in *NoDel* and *NoDel*[1], the analysis in the Online Appendix also provides insights into the effects of multiplicity of public goods on contributions and coordination. This investigation is closely related to the analysis conducted by CCV. Among other results, CCV found that contributions and coordination were significantly lower when subjects faced four identical public goods than when they are presented with a single public good; when there were four goods and one good stood out as being more efficient than the other three, contributions were similar to what was observed in the single public good setting. The current multiple public good environment is different from any of the cases considered in CCV in that donors face 12 alternative public goods and four of them stand out as being more efficient than the other eight. In the current environment, multiplicity only plays a marginal role in affecting group performance. Going from an environment with a single public good to one in which there are 12 public goods and four of them stand out as efficient is less detrimental for contributions than going to an environment with only four public goods, all equally efficient. We discuss this difference in more detail in the online Appendix, but we hypothesize that the efficiency differences between the public goods leads the subjects to initially shift their focus to achieving coordination on an efficient good rather than shifting their attention to a no-contribution strategy.

6 Discussion and conclusion

Intermediary NGOs, community chest organizations, Telethons and other philanthropic initiatives play prominent roles in charitable giving. They collect contributions from individual donors and coordinate their efforts across causes and projects. Such organizations potentially offer several benefits, from encouraging giving to helping donor learn about the most pressing issues. Of particular interest to the current paper is the role these organizations play in improving the efficiency of philanthropic giving, helping facilitate coordination among donors. Intermediary organizations, for example, can direct donors' contributions to a select set of programs, increasing their chance of making a difference, and reducing the risk that well-intentioned donors spread their contributions too thinly across too many programs and causes to have a meaningful impact.

From earlier experiments, we know that such risks of mis-coordination among donors can discourage contributions to public goods and lead donors to shy away from charitable giving. This suggests that intermediary organizations, to the extent that they reduce the risk of donor mis-coordination, may encourage contributions and increase the success of donor supported programs and projects.

The current paper investigates this issue in a series of lab experiments using threshold public goods, which require donors to coordinate contributions to be successful. This is a similar setting as CCV, except that we add to the environment an intermediary player. Others can choose to provide contributions through the intermediary, to contribute directly to any of several public goods, or to not contribute at all. The intermediary chooses how to allocate their own resources and the contributions provided to her by others across goods.

Perhaps unsurprisingly, we find that under the right conditions, the presence of an intermediary can increase public good success and overall welfare. More interestingly, however, we show how the presence of an intermediary can also have the opposite effect, as it discourages contributions and reduces the probability of public goods receiving enough funding to be successful. In our experimental setting, the benefit of an intermediary depends on whether or not the intermediary is formally committed not to redirect donations received from others to uses that may be beneficial to the intermediary but are not preferred by the donors themselves. Although the theoretical analysis shows that formal commitment is not needed for an intermediary for directing delegated contributions to the socially optimal public goods, the experimental analysis finds that formal commitment is essential for encouraging donor contributions and public good success.

Traditionally, the introduction of destination rules in the nonprofit sector has been justified by the necessity to guarantee institutional transparency, justice and correspondence between donors' initial intent and NGOs' actions. Our results add a further economic justification to introduce these formal restrictions. By reducing the perceived risk that an NGO could misuse donations, destination rules encourage donations, while allowing the intermediary to facilitate coordination across alternative projects, producing substantial welfare improvements for the society.

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